

Computer Methods For Vehicle Crash Safety Robust Design

L. Gu and R. J. Yang

Ford Research Laboratory
Ford Motor Company
2101 Village Road, MD2115-SRL
Dearborn, MI 48124
Phone: (313) 845-5916
Email: lgu@ford.com

The computer analysis of vehicle crashworthiness has become a powerful and effective tool in reducing the cost and time of bring new vehicles to market that meet corporate and government crash safety requirements. In addition to advances in high performance computing, the application of multidisciplinary design optimization (MDO) to automotive vehicle design for safety has been of significant interest over the last several years.

This presentation discusses several fundamental approaches aimed at simulations, optimization, and robustness analysis. They include:

- Basic formulations of finite element method with explicit time integration for vehicle crash simulations;
- Sampling techniques for computer experimental such as uniform design and Latin hyper cube sampling;
- Nonlinear response surface methodologies;
- Optimization and robustness assessment;
- Basic approaches of reliability-based design optimization, such as reliability index approach and performance measure approach;
- Robust design formulation.

The main focus is on the application of reliability-based design optimization methodologies to vehicle crash safety robust design. Some recent applications are presented to demonstrate how these approaches can be used.

References

[1] Yang, R. J., Gu, L., Tho, C., Choi, K. K. and Youn, B. D., 2002, "Reliability-Based Multidisciplinary Design Optimization of a Full Vehicle System," AIAA-2002-1753.